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evidence that the living cells of the organism are surrounded by semipermeable membranes with a difference in electrical potential outside and inside the membrane, and that any stimulus causes an increase of permeability with its necessary contractile and electrical effects. Again, the behavior of colloids in the form of gels leads one to believe that hydration-changes accompany response to stimuli in the protoplasm, which always involve contractile and electrical effects. These are probably the physical factors entering into BOSE'S "physiological" response and conduction. With death (coagulation of the colloids) both the membranes and the colloids disappear, and with them the "physiological" response.

Many statements in the book show a lack of familiarity with the anatomy and physiology of plants. The author speaks repeatedly of depleted energy in the pulvinus of *Desmodium*, or of its receiving energy from without. This is rather vague in the light of what we know of the energy relations of plants. He applies systole and diastole to the pulvinus as he does to the heart, and compares the petiole of *Mimosa* with the nerve and the pulvinus with the muscle of a nerve muscle preparation. Both of these statements are made in spite of the fundamental differences in structure and function. The death point for plant cells is fixed, as if mysteriously, at 60° C., and death from a lower temperature is spoken of as being very different in nature. BOSE fails to recognize that death at supramaximal temperatures is a matter of coagulation of certain proteins, and that at any supramaximal temperature the time of its application is a function in the process. At temperatures lower than 60° C. the time must be longer. The reason that 60° C., rather than a lower or higher temperature, is found to be the death temperature in a given species, is because of his method of heating, namely, 1° C. rise in temperature per minute. A slower heating would give a lower death point, and a faster one a higher one. The reason for the constancy of this temperature for the different species studied is not so clear. BOSE should have been acquainted with LEPESCHKIN'S[3] work on this subject. It is of some interest that the death temperature is lowered by fatigue to 37° C., and by copper sulphate to 42° C. This emphasizes again the marked lability of certain cell proteins, and reminds one of LEPESCHKIN'S results showing that they are coagulable even by pressure.

BOSE is adding much to the subject of plant response, but his excellent methods could add much more if they were applied in the light of our modern knowledge of the physics and chemistry of living cells and of plant response in general.—WILLIAM CROCKER.

Biology and capillary analysis of enzymes

GRÜSS[4] has brought together in book form the results of his work on enzymes, which has extended over a period of several years. Some of his conclusions are a decided departure from the usual conceptions regarding enzyme action. Probably the most striking departure is the assumption that different enzyme actions may be attributed to different atomic groups of the same enzyme; for example, malt diastase is also capable of cytase and peroxidase action. Many of the data upon which his conclusions are based are drawn from capillary analyses. This method for the separation of soluble substances the author has very ingeniously modified and elaborated for his particular purposes. With modifications excluded in special instances and stripped of details, the general method may be described as follows: A few drops of the enzyme mixture to be analyzed are placed upon filter paper. By capillary attraction a circular field is formed in which the dissolved substances arrange themselves in more or less distinct zones. In the case of colloidal substances, a greater spreading and separation is effected if a water ring is first placed upon the filter paper. Diffusion forces then come into play as well as capillary attraction. Diffusion is rendered more active if the solution to be analyzed contains a little glycerine. After spreading ceases, the capillary field is cut into sectors and each treated with a different reagent which gives a color reaction for a specific enzyme. The diastase test, for example, is carried out by placing firmly a sector of the capillary field upon a similar piece of filter paper moistened with a solution of soluble starch. After the diastase present in the sector of the capillary field has had sufficient time to hydrolyze the starch, the starch paper is treated with iodine solution. The presence and extent of the diastase in the field are then shown by a white area bordered by the blue-violet color of the starch iodine reaction. For peroxidase a sector is treated with guajak+H_2O_2; for oxydase, violamin is employed, etc. The treated sectors are all brought together to form the "chromogram," which shows the distribution or relative spreading of the different enzymes in the capillary field. If the same area is capable of more than one enzyme action, the author believes that it is due to a complex enzyme and not to the coexistence of different independent enzymes. He also believes that he has further confirmed his theory by showing that certain complex enzyme actions of capillary analysis appear also simultaneously in germination and are simultaneously destroyed by a given treatment of the enzyme preparation.

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[3] Ber. Deutsch. Bot. Gesells. **30**:703–714. 1913.

[4] GRÜSS, J., Biologie und Kapillaranalyse der Enzyme. 8vo. pp. vi+227. *col. pls. 2. figs. 58.* Berlin: Gebrüder Borntraeger. 1912. *M.* 16.

The enzymes of various embryos and endosperms, potato tubers, fungi, yeast, and latex were extensively studied with the aid of the capillary method, together with microchemical tests. The following are a few of the author's most important biological inductions: The enzymes and their anti-enzymes form systems in which the members oscillate around an equilibrium position. Upon these systems, which deserve the designation *Träger des Lebens*, rests the synthesis and disintegration of the cell substances. The most important system is the group of oxidizing enzymes: oxidase+peroxidase+antioxidase (hydrogenase). Antioxidase is simply a general term indicating any inhibition of an oxidase action. The antioxidase function is probably exercised by many different kinds of substances which are not all of an enzyme nature, since in many cases they are changed by their own activity and are not destroyed by hot alcohol. The enzyme nature of hydrogenase, however, is not to be doubted. It performs its function by liberating nascent hydrogen which unites with the oxygen carried by the oxidase to form water or hydroxyl groups; the latter can be employed for the formation of metabolic products. By these formations the oxidation of other substances is prevented. "Reductase" is a *contradictio in adjecto*. "Catalase" is merely a term to designate the decomposition of H_2O_2, and its place in the category of enzymes is extremely hypothetical. Amylocoagulase is the anti-enzyme of diastase in the sense that its action is just the opposite of that of diastase. The coagulase may be entirely obscured by the action of diastase, but it cannot be reversed. Cytocoagulase is another synthetic enzyme which acts in opposition to cytase.

The chief value of the book lies in the mass of experimental details and the ingenious methods devised for the study of enzymes. It will find its greatest usefulness among those especially interested in enzymes, as the treatment is rather technical.—CHAS. O. APPLEMAN.

Field manual of trees

An addition to the already numerous tree manuals has come[5] in the form of a thin pocket volume, 4.5 by 7 inches, bound in flexible leather, making it particularly convenient for field use. It is designed to include all the native and many of the introduced species north of Virginia and Kentucky and east of the prairie region. The features which recommend this manual are the numerous keys, all of which appear to be accurate and rather simple. They include separate ones for the genera based on (1) summer condition, (2) winter condition, (3) flowers, and (4) fruit, as well as keys for species under each genus and a general classification of the wood of the trees. The descriptions of the species seem to be good, but it is certainly unfortunate that such well known trees as the black and choke cherry should appear under such scientific names as *Prunus virginiana* and *P. nana* respectively, and that the flowering dogwood should be removed from the genus *Cornus*. Whatever may be the arguments of the systematist for such a course, it is certainly likely to lead to confusion, especially in a manual where no synonyms are given. One also misses the illustrations which have been a prominent feature of many recent volumes on trees.—GEO. D. FULLER.

MINOR NOTICES

Botanical researches of the Carnegie Institution.—The annual report[6] for the past year gives an idea of the various lines of research completed and

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[5] SCHAFFNER, JOHN H., Field manual of trees, including southern Canada and the northern United States to the southern boundary of Virginia, Kentucky, and Missouri, westward to the limits of the prairie. Columbus (Ohio): R. G. Adams & Co. 1914. 16mo. pp. 154. Cloth $1.25. Limp leather $1.75.

[6] MACDOUGAL, D. T., Annual report of the director of the department of botanical research. Carnegie Institution of Washington, Year Book No. 12 for 1913:57–87. 1914.